CLAIMS:

What is claimed is:

1. A method comprising:
operating a tire pressure monitoring system in a first operating mode;
using a piezoelectric sensor to sense vibration;
determining that an output signal of the piezoelectric sensor is above a predetermined threshold; and
setting the tire pressure monitoring system to a second operating mode based upon the determination that an output signal of the piezoelectric sensor is above a predetermined threshold.

2. The method of claim 1, wherein during the first operating mode, an output of a first sensor is sampled at a first sample rate and during the second operating mode the output of the first sensor is sampled at a second sample rate.

3. The method of claim 2, wherein the first sample rate is slower than the second sample rate.

4. The method of claim 2, wherein the first sensor is a tire pressure sensor.

5. The method of claim 2, wherein the first sensor is a temperature sensor.

6. The method of claim 1, wherein the piezoelectric sensor senses random vibration caused by a wheel rotating over a surface.

7. The method of claim 1, further comprising:

setting a counter value at a first predetermined value;

determining that the output signal is below the predetermined threshold during a sample time;

changing the counter value in response to the determining that the output signal is below the predetermined threshold;

determining that the counter value is a second predetermined value; and

setting the tire pressure monitoring system to the first operating mode in response to the determining that the counter value is the second predetermined value.

8. The method of claim 1, further comprising amplifying the output signal of the piezoelectric sensor.

9. The method of claim 1 further comprising:

amplifying the output signal of the piezoelectric sensor intermittingly, wherein the determining is performed when the output signal is being amplified.

10. The method of claim 9 wherein the amplifying is controlled by the assertion of a sample signal from a controller of the tire pressure monitoring system.

11. The method of claim 1, wherein the setting the tire pressure monitoring system to the second operating mode based upon the determination that an output signal of the piezoelectric sensor is above a predetermined threshold further includes determining that the output signal is above the predetermined threshold for at least a second occurrence within a predetermined time before setting the tire pressure monitoring system to the second operating mode.

12. The method of claim 1, wherein the piezoelectric sensor is encapsulated in an encapsulant that includes one of a thermo-plastic material or a thermo set material.

13. The method of claim 12 wherein the encapsulant functions to amplify the vibration sensed by the piezoelectric sensor.

14. The method of claim 1, wherein the tire pressure monitoring system is implemented in a motorized vehicle.

15. The method of claim 14, further comprising:

transmitting information to a controller system of the motorized vehicle at a first rate during the first operating mode; and

and transmitting information to the controller system at a second rate during the second operating mode, the second rate being higher than the first rate.

16. A tire pressure monitoring system comprising:

a first sensor having an output for providing an indication of a sensed condition of a wheel;

a motion detection system, the motion detection system provides a motion indication indicative of wheel rotation, the motion indication is utilized for placement of the tire pressure monitoring system in a first operating mode or a second operating mode, wherein the motion detection system further comprises:

a piezoelectric sensor for sensing vibration of a wheel rotating over a surface, the piezoelectric sensor having an output to provide an output signal indicative of an amplitude of the sensed vibration;

wherein the motion detection system utilizes the output signal in providing the motion indication.

17. The tire pressure monitoring system of claim 16 further comprising:

a controller;

wherein the controller samples an indication of the sensed condition as sensed by the first sensor at a first sample rate during the first operating mode;

wherein the controller samples an indication of the sensed condition as sensed by the first sensor at a second sample rate during the second operating mode;

wherein the second sample rate is higher than the first sample rate.

18. The tire pressure monitoring system of claim 16 further comprising:

a controller;

a transmitter operably coupled to the controller;

wherein the controller initiates transmitting by the transmitter of information at a first transmitting rate during the first operating mode;

wherein the controller initiates transmitting by the transmitter of information at a second transmitting rate during the second operating mode;

wherein the second sample rate is higher than the first sample rate.

19. The tire pressure monitoring system of claim 16, wherein the first sensor is a pressure sensor for sensing air pressure inside a tire of a wheel.

20. The tire pressure monitoring system of claim 16, wherein the first sensor is a temperature sensor for sensing temperature inside a tire of a wheel.

21. The tire pressure monitoring system of claim 16 wherein the motion detection system further comprises:

a comparator having an input coupled to the output of the piezoelectric sensor and an output for providing an indication that the output signal of the piezoelectric sensor is greater than a predetermined threshold;

the motion indication is based upon the output of the comparator.

22. The tire pressure monitoring system of claim 21 further comprising:

a controller;

wherein the motion detection system further comprises a counter, the counter being reset to a first predetermined value each time the comparator output indicates that the output signal of the piezoelectric sensor is greater than the predetermined threshold, the counter counting each time the comparator indicates that the output signal of the piezoelectric sensor is not greater than a predetermined threshold during an assertion of a sample signal from the controller when a count value of the counter is not a second predetermined value;

wherein the motion indication is based on the count value of the counter.

23. The tire pressure monitoring system of claim 21 further comprising:

a controller;

wherein the motion detection system further comprises a counter, the counter counting each time the comparator indicates that the output signal of the piezoelectric sensor is not greater than the predetermined threshold during an assertion of a sample signal from the controller when a counter value of the counter is not at a predetermined value;

wherein the motion indication is at a state indicating motion when the counter value is not at the predetermined value.

24. The tire pressure monitoring system of claim 23 wherein the motion indication is at a state indicating no motion when the counter value is at the predetermined value.

25. The tire pressure monitoring system of claim 21 wherein the motion detection system further comprises:

an amplifier having an input coupled to the output of piezoelectric sensor and an output coupled to the input of the comparator.

26. The tire pressure monitoring system of claim 16 further comprising:

a controller;

wherein the motion detection system further comprises an amplifier having an input coupled to the output of piezoelectric sensor, the amplifier amplifying the output signal when turned on;

wherein the controller provides a sample signal;

wherein the motion detection system further includes circuitry to turn on the amplifier during an assertion of the sample signal.

27. The tire pressure monitoring system of claim 16, wherein the first operating mode is characterized as being a lower power operating mode than the second operating mode.

28. The tire pressure monitoring system of claim 16, wherein the piezoelectric sensor is made of a piezoelectric material having a first Young's Modulus, the piezoelectric sensor is encapsulated in an ecapsulant having a second Young's Modulus that is more elastic than the first Young's Modulus.

29. The tire pressure monitoring system of claim 28 wherein the encapsulant functions to amplify vibration sensed by the piezoelectric sensor.

30. The tire pressure monitoring system of claim 16 further comprising:

a controller;

wherein the piezoelectric sensor and the controller are encapsulated together in a package.

31. The tire pressure monitoring system of claim 30, further comprising a lead frame having a first side and a second side, the piezoelectric sensor being mounted on the first side and the controller being implemented in an integrated circuit die mounted on the second side, wherein at least a portion of the lead frame is encapsulated with the piezoelectric sensor and the controller.

32. A motorized vehicle including the tire pressure monitoring system of claim 16, the motorized vehicle further comprising:

a wheel including a tire, the tire pressure monitoring system physically coupled to the wheel to monitor air pressure of the tire.

33. The motorized vehicle of claim 32 further comprising:

a controller system including a receiver;

wherein the tire pressure monitoring system transmits tire pressure information of the tire to the controller system at a first rate in the first operating mode and transmits tire pressure information of the tire to the controller system at a second rate in the second operating mode;

wherein the second rate is greater than the first rate.

34. The tire pressure monitoring system of claim 16 wherein the motion detection system further comprises a counter, the counter preventing the tire pressure monitoring system from operating in the second operating mode until after at least two samples of the output signal from the piezoelectric sensor are above a predetermined threshold within a predetermined time.

35. The tire pressure monitoring system of claim 16 wherein the motion detection system further comprises a capacitive element, coupled in series to the output of the piezoelectric sensor for increasing a sensitivity of the output signal of the piezoelectric sensor.

36. The tire pressure monitoring system of claim 16 wherein the motion detection system further comprises a shunt resistive element, coupled in parallel to the output of the piezoelectric sensor for decreasing a sensitivity of the output signal of the piezoelectric sensor.

37. The tire pressure monitoring system of claim 16 further comprising:

a controller, wherein at least some operations of the motion detection system are performed by the controller.

38. A tire pressure monitoring system comprising:

a pressure sensor having an output for providing an indication of a sensed pressure inside a tire;

a controller having an input for sampling an indication of the sensed pressure at a first sample rate during a first operating mode and for sampling an indication of the sensed pressure at a second sample rate during a second operating mode, the second sample rate being greater than the first sample rate; and

a motion detection circuit, comprising:

a piezoelectric sensor for sensing vibration of a wheel rotating over a surface, the piezoelectric sensor having an output to provide an output signal indicative of an amplitude of the sensed vibration;

an amplifier having an input coupled to the output of the piezoelectric sensor and an output;

a comparator having an input coupled to the output of the amplifier, the output of the comparator providing an indication that the output signal of the piezoelectric sensor is greater than a predetermined threshold;

wherein the operating mode of the tire pressure monitoring system is based upon the comparator output.